While agreeing that the claims are patentable, it is not clear what the Examiner's position is on the feature regarding the "specifically claimed eutectic composition." If the Examiner believes that the composition specified in at least the broad independent claims is novel, he is encouraged to review the prior art of record, including the information reported in:

(1) "Methods Of Investigation Of Properties Of Powder Materials, Interactions In The Al_2O_3-ZrO_2-Y_2O_3 System", Lakiza et al., Powder Metallurgy and Metal Ceramics, Vol. 33, Nos. 9-10, 1994, pp. 486-490;

(2) "Solidus Surface And Phase Equilibria During The Solidification Of Alloys In The Al_2O_3-ZrO_2-Y_2O_3 System", Lakiza et al., Powder Metallurgy and Metal Ceramics, Vol. 34, Nos. 1-2, 1995, pp. 64-67;

(3) "Metastable Phase Relationships In The System Al_2O_3-ZrO_2-Y_2O_3", Lakiz and Lopato, Powder Metallurgy and Metal Ceramics, Vol. 35, Nos. 11-12, 1996, pp. 621-626;

(4) "Powder-Material Research Methods And Properties Polythermal Sections Of The Al_2O_3-ZrO_2-Y_2O_3 Phase Diagram", Lakiza et al., Powder Metallurgy and Metal Ceramics, Vol. 34, No. 11-12, 1995, pp. 655-659; and

(5) "The Liquidus Surface In The Al_2O_3-ZrO_2-Y_2O_3 Phase Diagram", Lakiza et al., Powder Metallurgy and Metal Ceramics, Vol. 33, No. 11-12, 1994, pp. 595-597.

all of which were cited in the PTO-1449 form included with the Supplement Information Disclosure Statement dated November 6, 2000.

It is submitted that the "specified nominal grade" feature, for the claims requiring such feature, and the abrasive article feature, for the claims requiring such feature, are clearly features that can be relied upon for patentability. And for simplification of prosecution, it is submitted that these features, as applicable, should be reasons for allowabilty. Further, although there may be other patentable differences of the claimed invention over U.S. Pat. No. 5,981,415 (Waku et al.), and Applicant reserves the right to argue any other differences, to simplify prosecution Applicant withdraws any arguments made for this application in distinguishing the claimed invention over '415 (Waku et al.) other than the arguments for arguing patentability based on the "specified nominal grade" feature or the "abrasive article feature", as applicable. The following are the arguments for patentability of the claimed invention based on the "specified nominal grade" feature or the "abrasive article" feature, as applicable.

In one aspect, Applicant claims, in claim 41, a plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of fused, crystalline abrasive particles, the fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 46, a method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$, the method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt;

converting the melt to the fused, crystalline abrasive particles; and

grading the fused, crystalline abrasive particles to provide plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of the fused, crystalline abrasive particles.

In another aspect, Applicant claims, in claim 53, an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 61, a vitrified bonded abrasive article comprising a plurality of abrasive particles bonded together via vitrified bonding material, wherein at least a portion of the plurality of abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

In another aspect, Applicant claims, in claim 69, a method of abrading a surface, the method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline ZrO_2 and (b) at least two of (i) crystalline Al_2O_3, (ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or (iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$;

contacting at least one of the fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted fused abrasive particle or the surface relative to the other to abrade at least a portion of the surface with the contacted fused abrasive particle.

In another aspect, Applicant claims, in claim 44, a plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of fused, crystalline abrasive particles, the fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 52, a method for making fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2, the method comprising:

melting at least one Al_2O_3 source, at least one Y_2O_3 source, and at least one ZrO_2 source to provide a melt;

converting the melt to the fused, crystalline abrasive particles; and

grading the fused, crystalline abrasive particles to provide plurality of abrasive particles having a specified nominal grade, the plurality of abrasive particle having a particle size distribution ranging from fine to coarse, wherein at least a portion of the abrasive particles is a plurality of the fused, crystalline abrasive particles.

In another aspect, Applicant claims, in claim 59, an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume

of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 67, a vitrified bonded abrasive article comprising a plurality of abrasive particles bonded together via vitrified bonding material, wherein at least a portion of the plurality of abrasive particles are fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2.

In another aspect, Applicant claims, in claim 72, a method of abrading a surface, the method comprising:

providing an abrasive article comprising a binder and a plurality of abrasive particles, wherein at least a portion of the abrasive particles are fused, crystalline abrasive particle comprising at least 20 percent by volume, based on the total volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2;

contacting at least one of the fused, crystalline abrasive particles with a surface of a workpiece; and

moving at least one of the contacted fused abrasive particle or the surface relative to the other to abrade at least a portion of the surface with the contacted fused abrasive particle.

It is said in the Office Action (dated March 7, 2002) that Applicant appears to argue that '415 (Waku et al.) does not teach the "specified nominal grade" as required by the instant claims. The Examiner disagrees with this argument because the reference is said to state that the material is crushed and it is the Examiner's position that this crushed material will have a size which either falls in the category of coarse or fine, which is Applicant's definition of specified nominal grade.

It is submitted that the meaning attributed to the term "specified nominal grade" is defined on page 20, lines 20-31, bridging paragraph, page 21, lines 1-7 as industry (i.e., **abrasive** industry) accepted grading standards such as American National Standards Institute, Inc. (ANSI) standards, Federation of European Producers of Abrasive Products (FEPA) standards, and Japanese Industrial Standard (JIS) standards. It is well understood by one of ordinary skill in the abrasive art that such standards require more than just a particle size distribution from fine to coarse, and that the particular distribution is dictated by the standard for a given nominal grade.

It is submitted that by requiring a specified nominal grade, the specified abrasive particles must be in a specific form (i.e., part of a plurality of particles in grade). Further, it is submitted that requiring the particles to be in such a specific form is a limitation that must be considered in evaluating the patentability of the claims. Moreover, it is submitted that the Office Action (dated March 7, 2002) does not provide a proper teaching or suggestion, for example, of the specified nominal grade" requirement set forth in Applicant's claims.

Further, it is stated in the March 7, 2002 Office Action that Applicant apparently argues the "abrasive particle" limitation, as defined in the previous office action (i.e., Waku et al. teaches that fused materials based on alumina and yttria are known to be used as abrasive materials, thus making the use of the fused material according to the primary reference obvious as an abrasive material), as not being obvious, yet fail to define reasons supporting this position. It is also stated in the March 7, 2002 Office Action that clearly one skilled in the art from reading column 2, line 54 and the paragraph bridging columns 8-9 of Waku would find the use of the material according to the EP* reference obvious as an abrasive. Applicant is said to state that this obviousness rejection is based on improper hindsight. The Examiner disagrees with this argument because it is said one skilled in the art would have known the applications of alumina/oxide composites includes abrasive applications, as defined in Waku.

As discussed above, "specified nominal grade" is defined on page 20, lines 20-31, bridging paragraph, page 21, lines 1-7 as industry (i.e., **abrasive** industry) accepted grading standards, and requiring the abrasive particles to be in such a specific form is a limitation that must be considered in evaluating the patentability of the claims, although since '415 (Waku et

* The current rejections do not rely an EP document.

al.) fails to teach the eutectics required in Applicant's claims, reliance on the specified nominal grade requirement is not even necessary to distinguish the invention from '415.

Although it is stated in the Office Action that "[c]learly one skilled in the art from reading column 2, line 54 and the paragraph bridging columns 8-9 of Waku would find the use of the material obvious as an abrasive" and that "... one skilled in the art would have known the applications of alumina/oxide composites includes abrasive applications, as defined in Waku", it is submitted that column 2, line 54 and the paragraph bridging columns 8-9 of '415 (Waku et al.) fail to properly support such conclusions.

The sentence corresponding to col. 2, line 54, which is in the "Background of the Invention" section, reads "For example, Al_2O_3, is chemically stable and hard and has a relatively high strength and an excellent electrical insulation, and therefore it is widely used in various applications including insulating materials, abrasives, cutting tool materials, IC circuit boards, laser emitting materials, catalyst carriers, and biomaterials." The paragraph bridging at columns 8-9 of '415 (Waku et al.) reads:

> Also, the ceramic composite material of the present invention may be useful in many applications in which oxide ceramics such as Al_2O_3 are in practice used. Such applications include high temperature materials such as heat exchange members, fusion furnace materials, nuclear furnace materials and fuel cell materials; abrasion resistant members, cutting tool members, corrosion resistant materials, superconducting members, magnetic refrigeration materials, insulating members, phosphor materials, X-ray sensitizers, laser emitting elements, dielectric elements, positive temperature coefficient materials (PTC), condensers, varisters and other electronic devices, optical lenses, catalyst carriers, and many other applications.

It is worth noting that this list of uses of the '415 (Waku et al.) ceramic composite material (in paragraph bridging at columns 8-9) is significantly longer than the list of uses of Al_2O_3 in col. 2, and that some of the listed applications are the same. Although "abrasives" is listed in col. 2 as a use of Al_2O_3, it is not listed in the much longer list of uses in the bridging paragraph at col. 8-9

for the '415 (Waku et al.) ceramic composite material. If it was intended to teach or suggest the '415 (Waku et al.) ceramic composite material for use as an abrasive, it is puzzling why it was not listed with the other relatively long list of uses at col.. 8-9. Moreover, even if it were known that known abrasives include alumina/oxide composites, it would not necessarily mean that all alumina/oxide composites are suitable for use as abrasives.

Hence, it is submitted that to reach the conclusion that '415 (Waku et al.) teaches or suggests using the '415 ceramic composite material as abrasive particles in a specified nominal grade as required in Applicant's claims 41, 44, 46, and 52 requires an impermissible, strained reading of '415 that effectively includes the improper use of hindsight analysis.

Further, with regard to '415 (Waku et al.) in view of U.S. Pat. No. 4,035,162 (Brothers et al.), it is stated in the Office Action that Applicant fails to argue the combination of '415 (Waku et al.) in view of '162 (Brothers et al.).

Applicants respectfully disagree with this statement, however to facilitate prosecution, further clarification of the argument is provided below.

'162 (Brothers et al.) is relied upon to show that fused abrasive grains are known to be used as abrasives in the manufacture of bonded abrasives and coated abrasives.

Claims 53 and 61 are directed toward **abrasive articles** comprising fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$.

Claim 69 is directed toward **abrading a surface with an abrasive article** comprising fused abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline ZrO_2 and

(b) at least two of:

(i) crystalline Al_2O_3,

(ii) first crystalline complex $Al_2O_3 \cdot Y_2O_3$, or

(iii) second, different, crystalline complex $Al_2O_3 \cdot Y_2O_3$,

wherein at least one of such fused, crystalline abrasive particles abrades the surface.

Claims 59 and 67 are directed toward **abrasive articles** comprising fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least (a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and (b) crystalline ZrO_2.

Claim 72 is directed toward **abrading a surface with an abrasive article** comprising fused, crystalline abrasive particles comprising at least 20 percent by volume, based on the total metal oxide volume of the respective particle, eutectic material, wherein the eutectic material comprises eutectic of at least:

(a) crystalline complex $Al_2O_3 \cdot Y_2O_3$ and

(b) crystalline ZrO_2,

wherein at least one of such fused, crystalline abrasive particles abrades the surface.

As discussed above, '415 (Waku et al.) fails to teach or properly suggest use of the materials reported therein as abrasives. It follows that if '415 fails to teach or properly suggest use of such materials as abrasives, then '415 also fails to teach or properly suggest use of such materials as abrasives in abrasive articles.

As there is no teaching or proper suggestion in '415 (Waku et al.) of the '415 materials as abrasives, it is unclear, for example, why one of ordinary skill in the art would be motivated, absent the inappropriate use of hindsight analysis, to select '162 (Brothers et al.) to try to provide the inventions claimed in claims 53, 59, 61, 67, 69, and 72.

Further, with respect to the new rejection of claims 5-8, 20, 26, and 32 it is stated in the March 7, 2002 Office action that after further review of the reference and since Waku et al. states the "material **may** have a uniform structure which does not include colonies, it is the Examiner's position that the term **may** in this statement does not positively exclude colonies from being present, thus said colonies are within the scope of the reference. In view of colonies being present, the limitations of the above claims are met because colonies must have a size and the broad interpretation of the colonies having the claimed size in the absence of any critical evidence showing the contrary.

While not agreeing that the statements in the Office Action with respect the rejection to claims 5-8, 20, 26, and 32 are correct, it is submitted that since claims 5-8, 20, 26, and 32 depend directly or indirectly from one of the independent claims discussed above, and since the independent claims are patentable, for example, for the reasons given above, claim 5-8, 20, 26, and 32 should also be patentable irregardless of whether or not such statements are correct or not.

Claims 2, 17 and 75-76 add additional limitations to claim 41. Claim 41 is patentable for the reasons given above. Thus, claims 2, 17 and 75-76 should also be patentable.

Claims 3, 16 and 23 add additional limitations to claim 2. Claim 2 is patentable for the reasons given above. Thus, claims 3, 16 and 23 should also be patentable.

Claims 4-5, 7, and 9-11 add additional limitations to claim 3. Claim 3 is patentable for the reasons given above. Thus, claims 4-5, 7, and 9-11 should also be patentable.

Claim 6 adds an additional limitation to claim 5. Claim 5 is patentable for the reasons given above. Thus, claim 6 should also be patentable.

Claim 8 adds an additional limitation to claim 7. Claim 7 is patentable for the reasons given above. Thus, claim 8 should also be patentable.

Claim 18 adds an additional limitation to claim 17. Claim 17 is patentable for the reasons given above. Thus, claim 18 should also be patentable.

Claim 19 adds an additional limitation to claim 18. Claim 18 is patentable for the reasons given above. Thus, claim 19 should also be patentable.

Claims 20-22 add additional limitations to claim 19. Claim 19 is patentable for the reasons given above. Thus, claims 20-22 should also be patentable.

Claim 24 adds an additional limitation to claim 23. Claim 23 is patentable for the reasons given above. Thus, claim 24 should also be patentable.

Claim 25 adds an additional limitation to claim 24. Claim 24 is patentable for the reasons given above. Thus, claim 25 should also be patentable.

Claims 26-28 add additional limitations to claim 25. Claim 25 is patentable for the reasons given above. Thus, claims 26-28 should also be patentable.

Claim 30 adds an additional limitation to claim 44. Claim 44 is patentable for the reasons given above. Thus, claim 30 should also be patentable.

Claims 31-35 add additional limitations to claim 30. Claim 30 is patentable for the reasons given above. Thus, claims 31-35 should also be patentable.

Claims 45 and 78-80 add additional limitations to claim 44. Claim 44 is patentable for the reasons given above. Thus, claim 45 and 78-80 should also be patentable.

Claim 47 adds an additional limitation to claim 46. Claim 46 is patentable for the reasons given above. Thus, claim 47 should also be patentable.

Claims 48-49 add additional limitations to claim 47. Claim 47 is patentable for the reasons given above. Thus, claims 48-49 should also be patentable.

Claims 50-51 add additional limitations to claim 46. Claim 46 is patentable for the reasons given above. Thus, claims 50-51 should also be patentable.

Claims 54-58 add additional limitations to claim 53. Claim 53 is patentable for the reasons given above. Thus, claims 54-28 should also be patentable.

Claim 60 adds an additional limitation to claim 59. Claim 59 is patentable for the reasons given above. Thus, claim 60 should also be patentable.

Claims 62-66 add additional limitations to claim 61. Claim 61 is patentable for the reasons given above. Thus, claims 62-66 should also be patentable.

Claim 68 adds an additional limitation to claim 67. Claim 67 is patentable for the reasons given above. Thus, claim 68 should also be patentable.

Claims 70 and 71 add additional limitations to claim 69. Claim 69 is patentable for the reasons given above. Thus, claims 70 and 71 should also be patentable.

Claims 73-74 and 89 add additional limitations to claim 72. Claim 72 is patentable for the reasons given above. Thus, claims 73-74 and 89 should also be patentable.

Claims 81-88 add additional limitations to claim 69. Claim 69 is patentable for the reasons given above. Thus, claims 81-88 should also be patentable.

In summary, the rejections of claims 2-12, 16-19, 20-28, 30-35, 41, 44-52 and 75-80 under 35 U.S.C. §103 as being unpatentable over '415 (Waku et al.), and claims 53-74 and 81-89 over '415 (Waku et al.) in view of '162 (Brothers et al.), should be withdrawn.

Also, referring to The Supplemental Amendment Under Rule 111 dated January 31, 2002, in line 5 of the last paragraph on page 8, "working examples 4 and 5" should read –working examples 4 and 6 and comparative example 4--.

Finally, the undersigned acknowledges with appreciation the brief telephone conversation with the Examiner shortly after the undersigned received the most recent Notice Of Allowance, wherein I indicated agreement that the claims are patentable, but that a clearer reason for allowance, and the one Applicant prefers, with regard to the "Reasons For Allowance" given, is the "specified nominal grade" feature for those claims including that feature.

Respectfully submitted,

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